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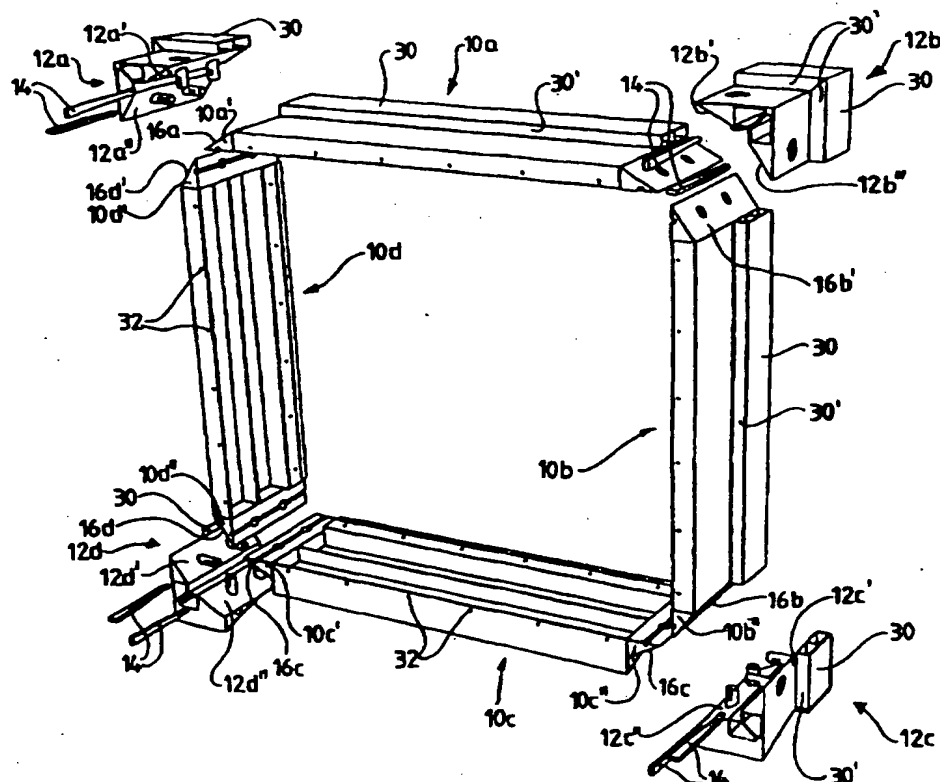
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(57) Abstract

A formwork frame comprising a rectangular/polygonal circumferential frame may, using relatively small dimensions, be utilized as a cavity-forming frame to be placed within a formwork/casting mould or, using relatively large dimensions, as a formwork/casting mould. The circumferential frame comprises loose intermediate pieces (10a-10d) to be jointed together with loose corner pieces (12a-12d). The corner pieces (12a-12d) and the end portions of the intermediate pieces (10a-10d) are provided with cooperating connecting means which are interlocked by means of external locking means in the form of wedges (14). The corner pieces (12a-12d) and the end pieces of the intermediate pieces (10a-10d) are provided with sloping faces for resting supportingly against each other. The connecting means of the corner pieces consist of fixed bolt means (possibly through-going bores for such bolt means) and the end portions of the intermediate pieces are formed with bores for said bolt means. Each of the bolt means is provided with a through-going lateral hole for one of said wedges (14).



## FORMWORK FRAME

The present invention relates to a formwork frame which, in a first order of a set of dimensions, may be used as (I) a cavity-forming frame intended to form part of a formwork or a casting mould for casting elements of concrete, e.g. concrete walls, where said cavity-forming frame is removed subsequent to casting and hardening of the concrete, leaving a cavity for a window/door/hatch or similar aperture, and which, in a second order of a set of dimensions - where the average dimensions are substantially larger than average dimensions of the first order - may be used as (II) a casting mould for casting concrete elements, e.g. concrete walls, and which, in a position of use where the casting mould is assigned a bottom wall, can be equipped with one or more cavity-forming frames, preferably of the previously mentioned type, resting on the top face of said bottom wall, said formwork frame (cavity-forming frame/casting mould) comprising separate, replacable intermediate pieces, possibly in the form of elongated, straight frame members having approximately equal cross-sections, as well as separate corner pieces, each exhibiting connecting means adapted to cooperate with corresponding connecting means of adjacent intermediate pieces for interconnection thereof.

Used as a cavity-forming frame, the formwork frame according to the invention belonging to a first order of a set of dimensions (corresponding to the external measures or dimensions of a door or window frame of this order), is

intended to form part of a formwork or casting mould for casting a foundation, a wall or another building component, for the purpose of, from the time of filling the concrete into the casting mould surrounding the cavity-forming frame until the time for stripping the forms, holding open a cavity, in order later to receive a door frame, a window frame or another component, such as a hatch, requiring an opening for its mounting in a wall, roof or the like.

Such, normally square cavity-forming frames are usually made from sawn wooden boards on the building site, a work which is time-consuming and expensive, especially because such temporary cavity frames can not be reused. Nor do such temporary cavity frames give a completely satisfactory result, i.a. because waterboard has to be casted separately after stripping the forms. Neither does one obtain a suitable stop edge as a counter means for e.g. a window frame.

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The object of the present invention is to provide a rational formwork frame (cavity-forming frame/casting mould) for the object concerned, said cavity-forming frame/casting mould should be intended for reuse and to be rapidly mounted and dismounted, adjusted to varying cavity-dimensions or concrete element-dimensions, respectively.

Another and very important object of the present invention has been to provide very strong corner connections, counteracting particularly torsional strains.

A specific object of the invention has been to enable the casting of waterboards in the same operation as for the rest of the wall, etc. Another specific object of the invention has been to enable the casting of a special stop edge for e.g. a window frame.

To this end, the invention distinguishes itself such as indicated in the following claims.

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A formwork fram (cavity-forming frame/casting mould) according to the invention comprises for the purposes involved loose corner pieces and loose intermediate pieces, wherein the intermediate pieces may have varying lengths and, possibly, also widths, but which - apart from special connecting pieces at the ends thereof - normally will exhibit the same cross-section form. The corner pieces may be mutually identical, thus facilitating to a high extent the interconnection of intermediate pieces and corner pieces, but, if the formwork frame is non-rectangular, at least one corner piece will differ from the remaining through the angular shaping thereof. At a pentagonal casting mould, two of the corner pieces may have an angular design equivalent to a right angle,  $90^\circ$ , two of the others will have an angular design larger than  $90^\circ$ , the fifth will have an angular design smaller than  $90^\circ$ .

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The connecting pieces at the ends of the intermediate pieces are formed with a connecting means adapted to cooperate with functionally complementary connecting means carried by the corner pieces. The connecting means of the intermediate pieces tapers appropriately in a direction outwardly, following a uniform slope, and each corner piece has two inclined faces adapted to rest and stop against such a sloping face on each of two adjacent intermediate pieces at one common corner.

The connecting pieces or end pieces of the intermediate pieces may, in a preferred embodiment of the invention, be provided with a key way extending laterally of the longitudinal direction of the associated intermediate piece, one, two or more bores extending within the key way, right angled at the longitudinal direction of the latter. These bores are intended to receive pins or bolts carried by each corner piece, each of the two inclined faces of the corner piece carrying one, two or more such pins, each of which is formed with a through-going lateral hole for the reception of a wedge which is driven into the key groove of

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the intermediate piece's end piece. Possibly, the wedges may hang from chains attached to the corner pieces. Upon demounting, the wedges are driven out, whereafter the individual members of the formwork frame, i.e. the intermediate pieces and the corner pieces, simply can be drawn apart, whereafter the intermediate pieces possibly are replaced in pairs with shorter or longer ones, adjusted to the dimensions of the desired cavity/concrete element.

The possibly replaced intermediate pieces are taken care of and kept in storage until a need for their dimensions/length arises again.

The intermediate pieces may consist of premanufactured profiles, e.g. extruded aluminium profiles.

Such formwork frames in the form of cavity-forming frames are stuck to the remaining formwork, e.g. a so-called cartridge formwork (main formwork) by means of nails. In the "front" and "rear" side (depending on which side that becomes the front and rear side upon boarding/casting) of the intermediate pieces, which will be aligned with the external faces of two parallel main formwork sides, there may advantageously be holes for nails to be beaten into the formwork sides.

Used as a cavity-forming frame the intermediate pieces of the formwork frame may suitably be shaped and designed such that the lower intermediate piece will exhibit a gradation for casting a waterboard directly. Externally, each intermediate piece is provided with a stop edge-forming portion or member, respectively, extending parallel to the former and which, subsequently to casting and removal of the formwork, leaves a circumferentially extending stop edge, against which e.g. a window frame may be brought to rest, positioning and supporting the latter.

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Remaining advantages, features and details of a formwork

frame (cavity-forming frame/casting mould) formed, shaped and designed in accordance with the principles of the invention, appear from the following description of two exemplary embodiments of the invention.

Reference is made to the drawings, wherein:

Figures 1 - 3 show a first embodiment in which the formwork frame according to the invention has the form of a cavity-forming frame, figures 4 - 9 showing a second embodiment where a formwork frame according to the invention has the form of a casting mould, the last-mentioned figures also showing an external strengthening and bracing system for the casting mould.

In the following, first embodiment - the cavity-forming frame - is described as such, and the same applies for second embodiment - the casting mould.

The individual figures of the drawing show as follows:

Figure 1 shows a perspective exploded view of a cavity-forming frame comprising four straight intermediate pieces having special end pieces and four mutually identical corner pieces belonging thereto, one at each joining point, as well as two in the embodiment loose wedges for each joining corner;

Figure 2 shows - on a substantially larger scale than in figure 1 - a perspective view of the lower, left corner of the cavity-forming frame prior to joining together the lower intermediate piece's left end, the left intermediate piece's lower end and the lower, left corner piece;

Figure 3 shows - on the same scale as in figure 2 - a perspective view of the lower right cavity-forming corner in an assembled condition, i.e. the right intermediate piece's lower end, the lower intermediate piece's right end and

the lower, right corner piece in a joined and locked condition.

Figure 4 shows a perspective view of a rectangular/square casting mould comprising two internally placed cavity-forming frames or boxes as well as an external strengthening and bracing system, the casting mould being positioned on a bottom plate, to which the strengthening and bracing system is attached;

Figure 5 shows a perspective exploded view of the casting mould, the cavity-forming frames and the bracing system according to figure 4;

Figure 6 shows a perspective view of a casting mould exhibiting a pentagonal circumference, built up according to the same principles as for the structure of figures 4 and 5, but where the loose corner pieces in the form of angle pieces exhibit various angles, two corner pieces each exhibiting an angle of  $90^\circ$ , two corner pieces an angle exceeding  $90^\circ$ , the fifth corner piece exhibiting an internal angle corresponding to the external angle which is less than  $90^\circ$ ;

Figure 7 shows, on a larger scale, a side elevational view of a bracing member forming part of said strengthening and bracing system for the casting mould;

Figure 8 shows an exemplary embodiment of a joining means between two shorter intermediate pieces in the form of intermediate piece sections adapted to form one intermediate piece having a length corresponding to the sum of the intermediate pieces joined together minus overlap;

Figure 9 shows a perspective exploded view of the members and fastening means included in the joint of figure 8.

In the following, the formwork frame in the form of a

cavity-forming frame is first described in accordance with figures 1 - 3.

In the drawings, reference indications 10a, 10b, 10c and 10d denote straight intermediate pieces, each consisting of a premanufactured, e.g. extruded aluminium profile, provided with special end pieces 10a', 10a'', 10b', 10b'', 10c', 10c'', 10d', 10d'' acting as connecting pieces. These end connecting pieces 10a', 10a'', 10b', 10b'', 10c', 10c'', 10d', 10d'' are mutually identical, facilitating production, interconnection and demounting.

In an ordinary rectangular cavity-forming frame, the intermediate pieces have the same length in pairs. Thus, opposing intermediate pieces 10a, 10c have the same length, and opposing intermediate pieces 10b, 10d have the same length. The lower intermediate piece 10c is, however, taller than the opposing intermediate piece 10a, in order to make the conditions right for casting a waterboard in the same operation as the rest of the casting of the foundation, wall or other building component which is to surround one or more cavities for window, door, hatch, etc. Thus, the lower intermediate piece 10c has a graded cross-section from one side face of the cavity-forming frame to the other side face thereof, a rear, taller portion of the intermediate piece 10c is denoted at 10c'''.

Mutually identical corner pieces are, generally, denoted at 12a, 12b, 12c, 12d.

Loose, mutually identical wedges 14, which possibly could have been connected in pairs to each of the corner pieces 12a - 12d through chains or the like, are shown in the exploded views of figure 1 and 2 and in the operative position in figure 3. They will later on be described in connection with connecting means on the corner piece/end piece, with which the wedges 14 cooperate.



Each intermediate piece's 10a - 10d end connecting pieces 10a', 10a", 10b', 10b", 10c', 10c", 10d', 10d" has a sloping face denoted at reference indications 16a, 16a', 16b, 16b', 16c, 16c', 16d, 16d'.

Each corner piece 12a - 12d has two sloping faces 12a', 12a", 12b', 12b", 12c', 12c", 12d', 12d" forming an obtuse angle with each other, and which are adjusted according to the slope of the end connecting pieces 10a', 10a", 10b', 10b", 10c', 10c", 10d', 10d" and which, at each corner of the cavity-forming frame, cooperate with and rest against two adjacent sloping faces 16a, 16a' - 16d, 16d' of the end connecting pieces, e.g. 16c, 16d, of two intermediate pieces, figure 2.

In order to ensure that the sloping faces of the corner pieces and the end connecting pieces rest supportingly against each other and to lock the corner jointings, each corner piece and each end connecting piece are equipped with mutually cooperating and interlocking connecting means.

In order not to overburden the general drawing of figure 1 with reference numerals and indications, and as all corner connections are identical with each other, reference is made to figure 2 for the explanation of the shaping, design and mutual engagement of said connecting means, figure 2 showing the lowermost left corner of the cavity-forming frame of figure 1.

Therefore, reference is made to figure 2, wherein each of two adjacent end connecting pieces 10c' and 10d" are formed with a key way 18c and 18d, respectively, extending laterally in relation to the longitudinal direction of the intermediate piece concerned, 10c and 10d, respectively. Laterally of each of the longitudinal direction of these key ways 10c, 10d, two parallel bores 20c, 20c' and 20d, 20d' are formed.

On each of the sloping faces 12d', 12d" of the corner piece

12d, two parallel pins are mounted, i.e. two substantially horizontal pins 22d, 22d' on the sloping face 12d', and two substantially vertical pins 24d, 24d' on the sloping face 12d". In pairs, the pins 22d, 22d' and 24d, 24d' have the same distance from each other as the bores 20c, 20c' and 20d, 20d' and a slightly less diameter than the latter.

Each of the pins 22d, 22d' and 24d, 24d' is formed with a through-going lateral hole 26d, 26d' and 28d, 28d' which, in pairs, are intended to accommodate a wedge 14 to be driven into the key way 18c and 18d, respectively, of the end connecting pieces 10c' and 10d", after the pins 24d, 24d', 22d, 22d' beforehand have been inserted entirely into the bores 20c, 20c', 20d, 20d'.

When the wedges 14 have been driven in through the lateral holes 28d, 28d', 26d, 26d', guided and wedged within the key ways 18c, 18d, one has achieved a centered, secure fixing of the corner connection which, nevertheless, may be disassembled very rapidly.

A ready-assembled and locked corner of a cavity-forming frame is shown in figure 3.

In order to obtain a circumferential stop edge, against which e.g. a window frame can be brought to rest positionally and supportingly when the formwork has been removed, the cavity-forming frame may externally be provided with a straight portion/element 30 having an edge face 30' withdrawn in relation to one side face of the cavity-forming frame. Completing element pieces 30 are carried by the corner pieces 12a - 12d.

In order to stick cavity-forming frames according to the invention to the main formwork through nailing, the intermediate pieces of the formwork frame are provided with a plurality of through-going holes 32 for nails. Thus, after the cavity-forming frame has been stuck to the main formwork,

the cavity-forming frame is attached to the main formwork in such a way that it becomes firmly fastened during the casting operation, nails being beaten through the main formwork and into a replaceable lathe 33 fastened to the intermediate pieces 10a, 10b, 10c and 10d.

In the following, a formwork frame according to the invention in the form of a casting mould will be explained, such casting mould being adapted for casting a concrete element, e.g. a wall, in reinforced concrete, said casting mould being built up substantially in accordance with the same principles as those of the cavity-forming frame previously described. Thus, it is primarily differing dimensions that distinguish the two designs of a formwork frame according to the invention, the cavity-forming frame being built according to the order of a first set of dimensions where the dimensions substantially correspond to the external measures of a door frame or a window frame, the casting mould being built according to the order of a second set of dimensions where the dimensions e.g. may correspond to the dimensions of a building element, i.e. dimensions substantially exceeding the order of the first set of dimensions. Such a casting mould might contain one or more cavity-forming frames where one or more cavities are desired to be positioned within the casted concrete element.

The casting mould according to figures 4 and 5 comprises four intermediate pieces 110a, 110b, 110c and 110d, four identical 90° corner pieces 112a, 112b, 112c and 112d as well as a horizontal bottom plate 134. Two cavity-forming frames or boxes 136 (for window openings or similar cavities) are fixed to the bottom plate 134.

The four corner connections for a parallelepipedon-shaped casting mould according to figures 4 and 5 could have been formed completely in accordance with the corner connections of the cavity-forming frame 10a-10d as shown in figures 1 - 3, i.e. with key ways (18b, 18c, 18c', 18d) in combination with

bores (20c, 20c', 20d, 20d') in the end connecting piece (10a', 10a" - 10d', 10d") of the respective intermediate piece, and with fixed pins/bolts (22d, 22d', 24d, 24d') on the corner pieces (12a - 12d), but in the casting mould shown in figures 4 - 6, the corner connections are formed somewhat simplified and different. The technical solutions associated with said corner connections, give in both cases strong, firm, tensioned connections particularly resistant to torsional strains, to which the intermediate pieces may be subjected during casting. For cavity-forming frames, the structure alone manages to resist the pressure from the concrete, but for a casting mould of the kind illustrated in figures 4 - 6, it is usually necessary to use an external bracing structure, generally denoted at reference numeral 138.

Internally and externally, each of the corner pieces 112a - 112d is right angled and is provided with 45° sloping free end edge faces 112a' - 112d' and 112a" - 112d", see figure 5. The adjacent end edge faces 110a' - 110d' and 110a" - 110d" each has a corresponding 45° slope, so that each corner piece's angle leg is aligned with adjacent intermediate piece when respective corner piece 112a - 112d is inserted between the ends of two adjacent intermediate pieces forming 90° with each other, see figure 4.

Through the sloping end portions of the corner pieces 112a - 112d, defined by the sloping faces 112a' - 112d' and 112a" - 112d" and adjacent inner side face of the respective corner piece, and through the sloping end portions of the intermediate pieces 110a - 110d, defined by the sloping faces 110a' - 110d' and 110a" - 110d" and adjacent outer side face (figure 5), in the exemplary embodiment, two vertically displaced bores 140a - 140d and 140a' - 140d' respectively 120a - 120d and 120a' - 120d' extend, see figure 5.

These bores serve, in pairs, e.g. the upper bore 140c' in the corner piece 112c and the upper bore 120c in the intermediate piece 110c, to accommodate cap bolts 142 having a through-

going hole for a wedge 114. In the perspective exploded view in figure 5, the wedges 114 are shown loosely inserted into the lateral hole of the cap bolts 142, the wedges 114 however, are driven into the lateral hole of the cap bolts not until the cap bolts 142 have been inserted through corresponding bores 140a - 140d and 140a' - 140d' in the inclined end portions of the corner pieces, and 120a - 120d and 120a' - 120d' in the inclined end portions of the intermediate pieces. The cooperating sloping faces 110a' - 110d', 110a'' - 110d'' and 112a' - 112d', 112a'' - 112d'', the cap bolts 142 and the wedges 114 secure a very strong corner connection. Alternatively, a corner connection exhibiting one common wedge for two adjacent pins/bolts, such as described in connection with figures 1 - 3, can be used. Inversely, the corner connection just described, exhibiting one wedge for each bolt, may be used in association with the embodiment in figures 1 - 3.

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Due to the substantial internal pressure from the concrete, the casting mould according to the exemplary embodiment of figures 4 - 9, should be assigned an external bracing structure, generally denoted at reference numeral 138. The bracing structure comprises, adjacent the sides of the casting mould, a number of supports 144 each having a triangular or trapezoidal circumferential shape and an internal bracing strut 146, as well as an external attachment beam 148 extending along all supports 144 at each casting mould side and being fixed by means of screw bolts 150 to the bottom plate 134 of the casting mould, and also a locking list 152 locking the supports 144 at one casting mould side to the attachment beam 148 belonging thereto.

The bracing structure has been shown on a larger scale in figure 7 showing a side elevational view. The elongated attachment beam has an upper groove 154 sloping towards the supports 144, exhibiting the same or substantially the same slope as the upper face thereof, the latter sloping at the same angle relative to the horizontal plane as the upper face

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of the attachment beam 148. A longitudinal extending portion 148' of the beam contributes to form the sloping groove 154. The longitudinal, elongated locking list 152 is pushed into the groove 154 and, thus, locks the supports 144 to the attachment beam 148 which itself is anchored to the bottom plate 134 by means of the bolts 150.

When the concrete element, e.g. a house wall, is ready-casted and the formwork (the casting mould and the bracing structure) is to be removed, it would be an advantage if the angle  $\alpha$  between the faces of support 144 and attachment beam 148 is less than ninety degrees ( $\alpha < 90^\circ$ ), causing an easier lifting of the bracing structure 138.

In figure 6, in a perspective view seen obliquely from above, a casting mould having a pentagonal circumference has been shown, comprising five intermediate pieces 110b, 110c 110d, 110e and 110f and five corner pieces 112c, 112d, 112e, 112f and 112g, wherein the corner pieces 112c and 112d each includes  $90^\circ$ , the corner pieces 112e and 112g exceeding  $90^\circ$ , the fifth corner piece 112f including a smaller angle than  $90^\circ$ . In other respects, the corner connections, internal cavity-forming frames 136 and external bracing structure 138 formed entirely in accordance with the embodiment already described in association with figures 4, 5 and 7.

Figures 8 and 9 show an example of an advantageous jointing means for jointing the intermediate pieces in particular, both those shown in figures 1 - 3 and those shown in the remaining figures, figure 8 showing a ready-established joint, while figure 9 shows an exploded view of the members included in this joint.

Two longitudinal sections 156, 156a of e.g. the intermediate pieces are, at opposing ends, cut slopingly, forming an angle  $\beta$  with the outside face 156', 156a' of the order  $45^\circ$ . An elongated prism having a right angled, isosceles cross-section serves as a jointing piece 158.

The prism-shaped jointing piece 158 and the two sections 156 and 156a have corresponding, through-going bores 160 and 162, respectively, for accommodating cap bolts 164, each being formed with a through-going, lateral hole 166 for a locking wedge 168 at the free shaft end, quite in accordance with the locking devices at the corners of the casting moulds in figures 4, 5 and 6, respectively.

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## C l a i m s

1. A formwork frame which, of the order of a first set's dimensions can be used as (I) a cavity-forming frame intended to form part of a formwork or a casting mould for casting concrete elements, e.g. concrete walls, where said cavity-forming frame subsequently to casting and hardening of the concrete is removed to leave a cavity for a window/door/hatch or similar aperture and which, of the order of a second set's dimensions, the average dimensions of which being substantially larger than average dimensions of said first set's order, can be used as a (II) casting mould for casting concrete elements, e.g. concrete walls, and, in a position of use, where the casting mould is assigned a bottom wall (134), can be equipped with one or more internal cavity-forming frames (136), said formwork frame (cavity-forming frame/casting mould) comprising loose, replaceable intermediate pieces (10a - 10d; 110a - 110d; 110b, 110c, 110d, 110e, 110f), possibly in the form of elongated, straight frame elements which, apart from the end portions, may have approximately the same cross-section, as well as loose corner pieces (12a - 12d; 112a - 112d; 112c - 112g), each of which exhibiting connecting means adapted to cooperate with corresponding connecting means of adjacent intermediate pieces for interconnection therewith, characterized in that each corner piece (12a - 12d; 112a - 112d; 112c - 112g) exhibits fixed bolt means (22d, 22d', 24d, 24d') or first bores (140a, 140a', 140b, 140b', 140c', 140d) for loose bolt means (142), respectively, said bolt means (22d, 22d', 24d, 24d'; 142) being adapted to engage into second, corresponding bores (20c, 20c', 20d, 20d'; 120a, 120a', 120b', 120c, 120c', 120d) formed into end portions of the intermediate pieces, said end pieces, alternatively, may be provided with fixed bolt means for engagement into said first bores (140a - 140d, 140a' - 140d') of the corner pieces (112a - 112d; 112c - 112g), and that each of said bolt means (22d, 22d', 24d, 24d'; 142) is formed with a through-going lateral hole (26d, 26d', 28d, 28d') for a wedge (14; 114).



2. A formwork frame as set forth in claim 1, characterized in that each intermediate piece (10a - 10d) has an end connecting piece (10a', 10a" - 10d', 10d") at each end or is formed with special end portions, respectively, said end connecting pieces/end portions each having a sloping face (16a, 16a' - 16d, 16d'; 110a' - 110d', 110a" - 110d") forming an acute angle relative to the associated intermediate piece's (10a - 10d; 110a - 110d; 110b - 110f) main planes (side faces) and which, in the respective formwork frame corner's assembled and locked condition, are intended to rest supportingly against a corresponding sloping face (12a', 12a" - 12d', 12d"; 110a' - 110d', 110a" - 110d") on the respective corner piece (12a - 12d), a wedge (14) being disposed for each of the two sloping faces (12a', 12a" - 12d', 12d") of the corner piece (12a - 12d) or a wedge (114) for each bolt means (142).

3. A formwork frame as set forth in claim 2, characterized in that each end connecting piece (10a', 10a" - 10d', 10d") of the respective intermediate piece (10a - 10d), in the area of said bores (20c, 20c', 20d, 20d'), is formed with a key way (18b, 18c, 18c', 18d), the axis thereof being positioned substantially in the same plane as the axes of said bores (20c, 20c', 20d, 20d').

4. A formwork frame as set forth in one or more of the preceding claims, characterized in that an intermediate piece (10c) which is intended to constitute the lower lateral element/frame piece of a formwork frame in the form of a cavity-forming frame, has a graded cross-section (10c'') for direct casting of waterboard simultaneously with the remaining casting operation, said waterboard downwardly defining the resulting cavity in the building component.

5. A formwork frame as set forth in any one of the preceding claims, characterized in that each of the

intermediate pieces (10a -10d) externally has a withdrawn edge (30') extending parallel to the two opposite side faces/planes of the formwork frame (the cavity-forming frame), said withdrawn edge (30') serving to enable direct casting of a stop edge extending around the resulting cavity in the building component, so that e.g. a window frame may be placed positionally and supportingly against said stop edge.

6. A formwork frame as set forth in claim 5, characterized in that each corner piece (12a - 12d) externally has a withdrawn edge (30') at two sides thereof, said withdrawn edges (30') completing the withdrawn edges (30') of the intermediate pieces (10a - 10d).

7. A formwork frame as set forth in claims 1 and 2, characterized in that the sloping faces (112a' - 112d', 112a" - 112d") of the corner pieces (112a - 112d) and the sloping faces (110a' - 110d', 110a" - 110d") of the intermediate piece end portions - in a rectangular formwork frame in the form of a casting mould - each forms an angle of about 45° relative to the adjacent side face of neighbouring corner piece and intermediate piece, respectively, said angle will be varying in other polygonal circumferential shapes for the formwork frame.

8. A formwork frame as set forth in claims 1 and 2, characterized in that the formwork frame in the form of a casting mould having an underlying bottom plate (134), is assigned an external bracing structure (138) consisting of a number of supports (144) closest to the side walls (intermediate pieces 110a - 110d; 110b - 110f) of the casting mould and an elongated attachment beam (148) disposed outwardly therefrom and extending along all supports (144) at one casting mould side, said attachment beam (148) being securable to outwardly projecting portions of the bottom plate (134) of the casting mould, an elongated locking list (152) being adapted to lock the supports (144)

to the attachment beam (148).

9. A formwork frame as set forth in claim 8, characterized in that each support (144) has a sloping face facing away from the respective intermediate piece, said sloping face substantially corresponding to an upwardly open groove's (154) slope, said sloping groove (154) being formed into an upper portion of the attachment beam (148), an elongated, straight locking list (152) having approximately the same length as the attachment beam (148), being adapted to engage lockingly into the sloping groove (154) and such that it, with an upper portion of the underside thereof, from above rests lockingly against said sloping face of each support (144).

10. A formwork frame as set forth in claim 9, characterized in that each support (144) and the outwardly therefrom positioned attachment beam (148) rest against each other along upright stop/land faces, forming an angle  $\alpha < 90^\circ$  relative to the horizontal plane.

11. A formwork frame as set forth in one or more of the preceding claims, characterized in a jointing device consisting of a prism-shaped jointing piece (158) adapted to be inserted into a cavity formed by sloping faces of section end portions (said sloping faces each forming an acute angle  $\beta$  relative to the outside face of each of the sections 156', 156a' to be jointed), the sloping end portions and respective jointing piece (158) having registering bores (162, 160) for bolt means (164) each having a through-going lateral hole (166) for one wedge (168) each.

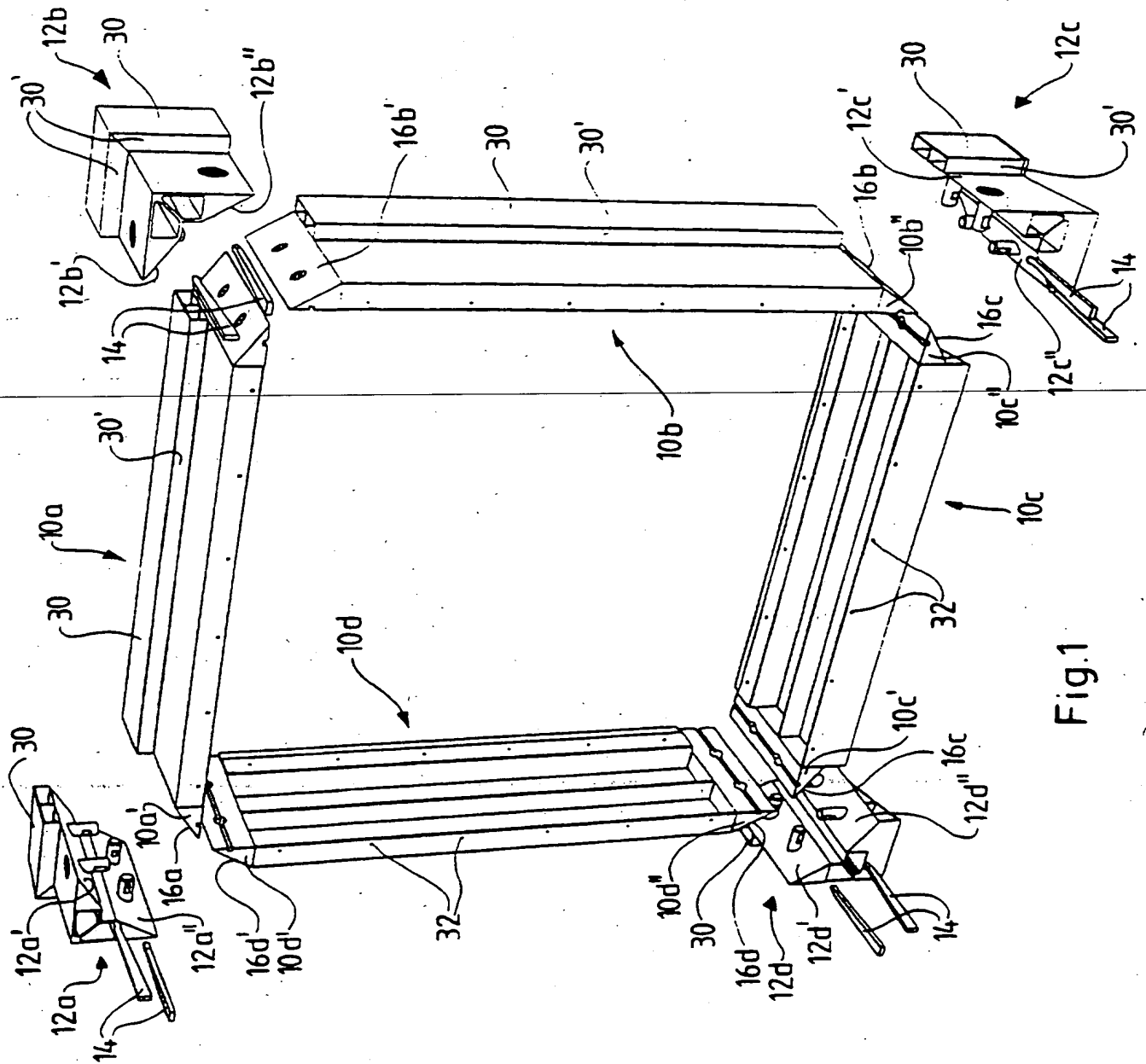


Fig.1

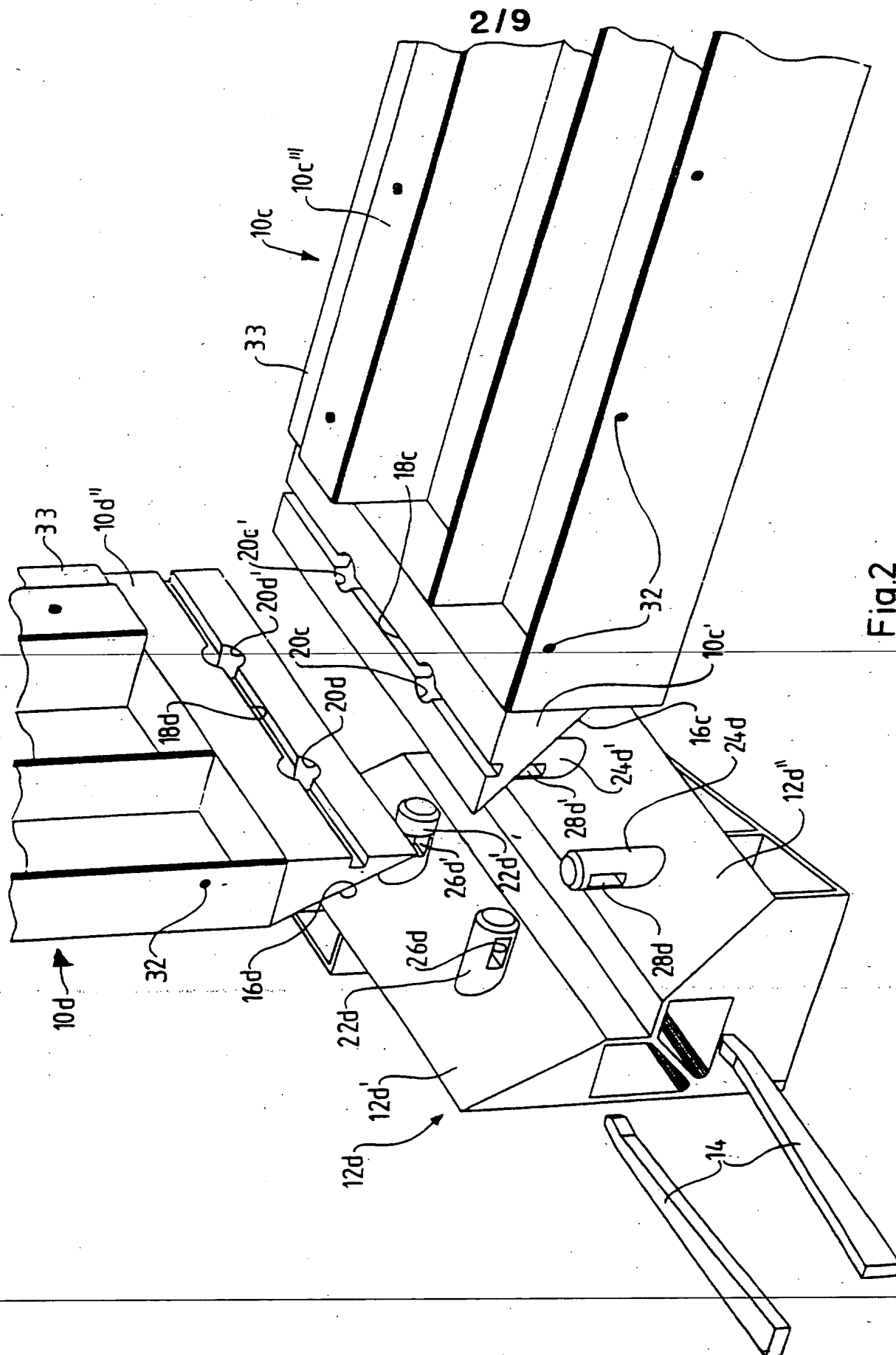


Fig.2

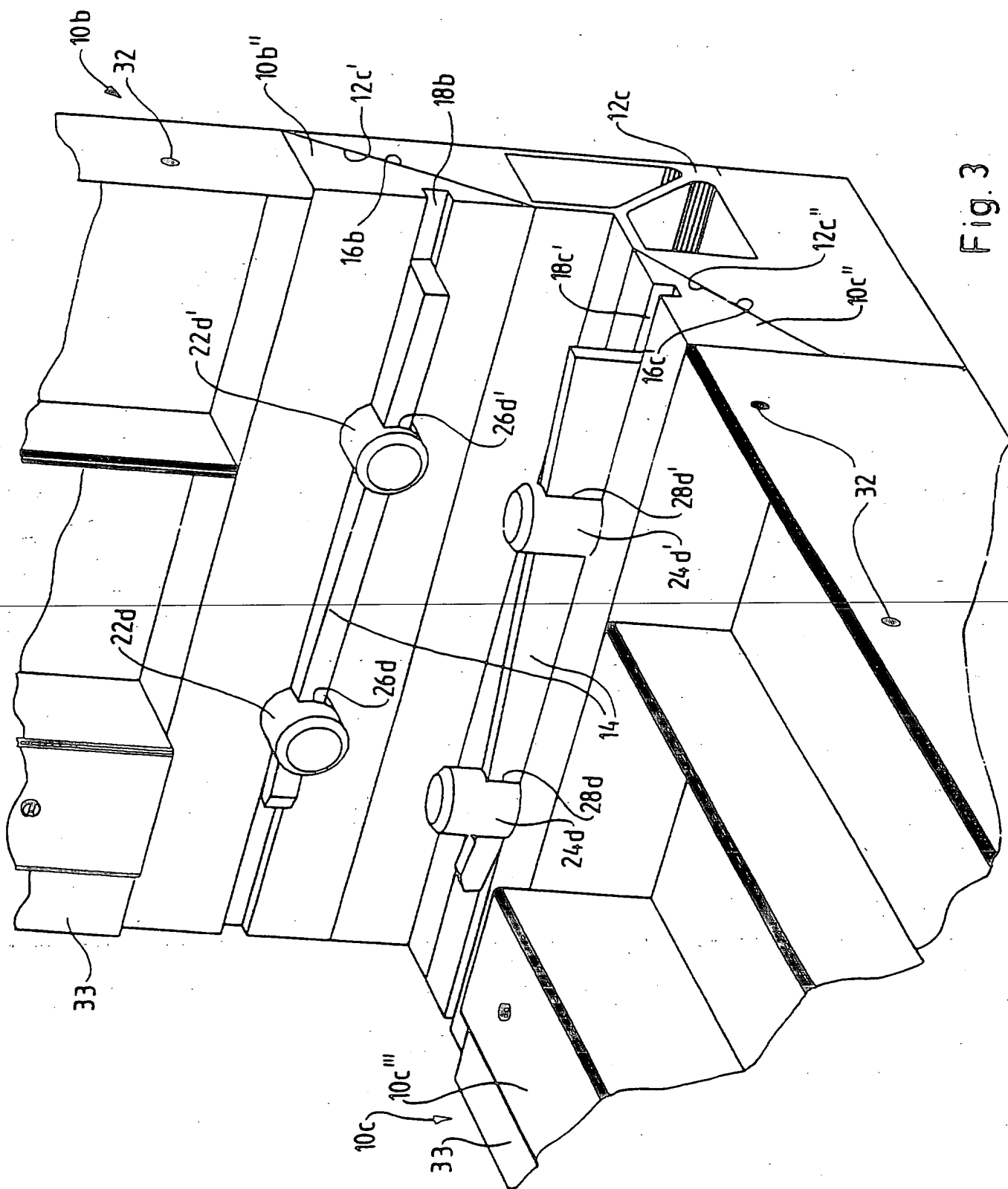


Fig. 3

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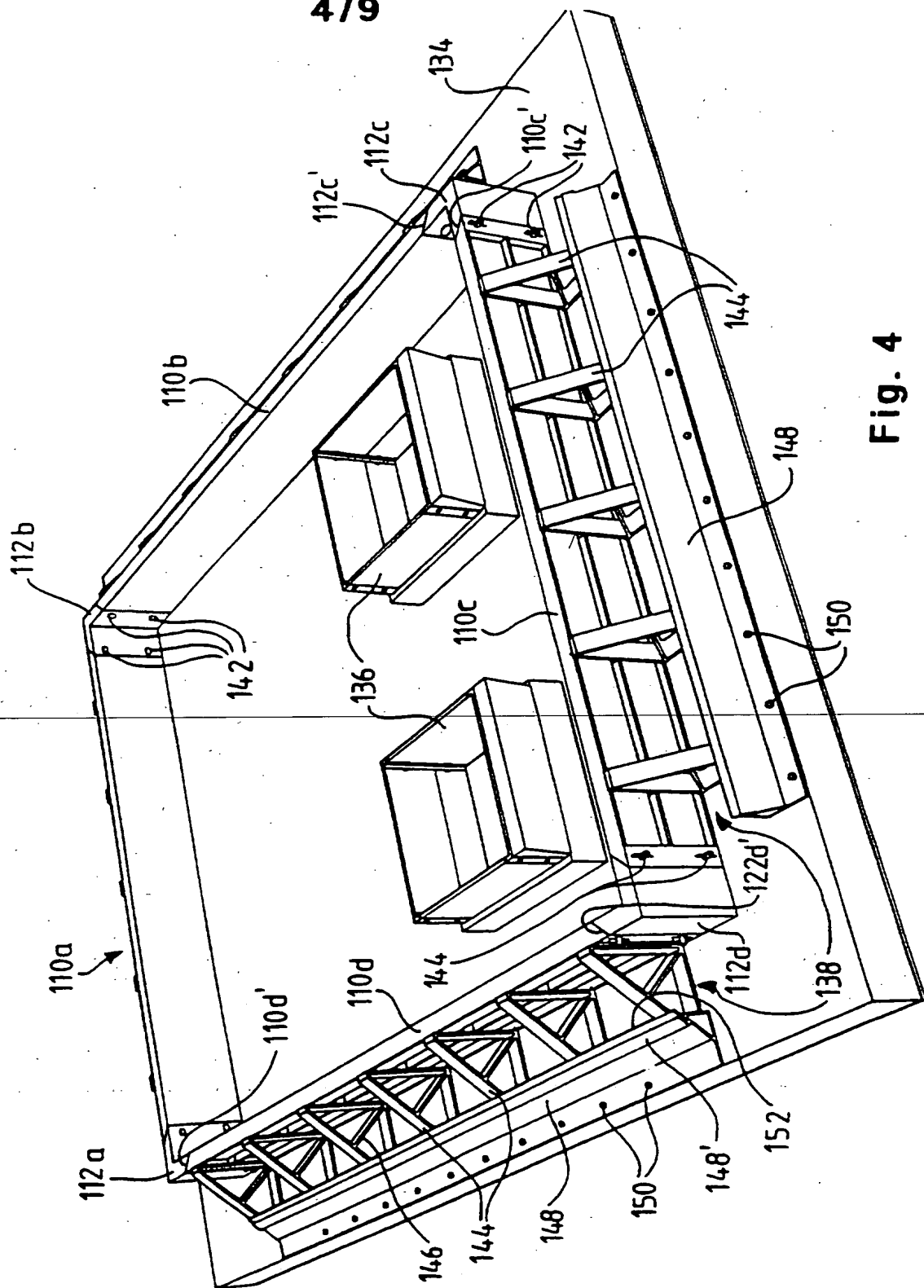


Fig. 4

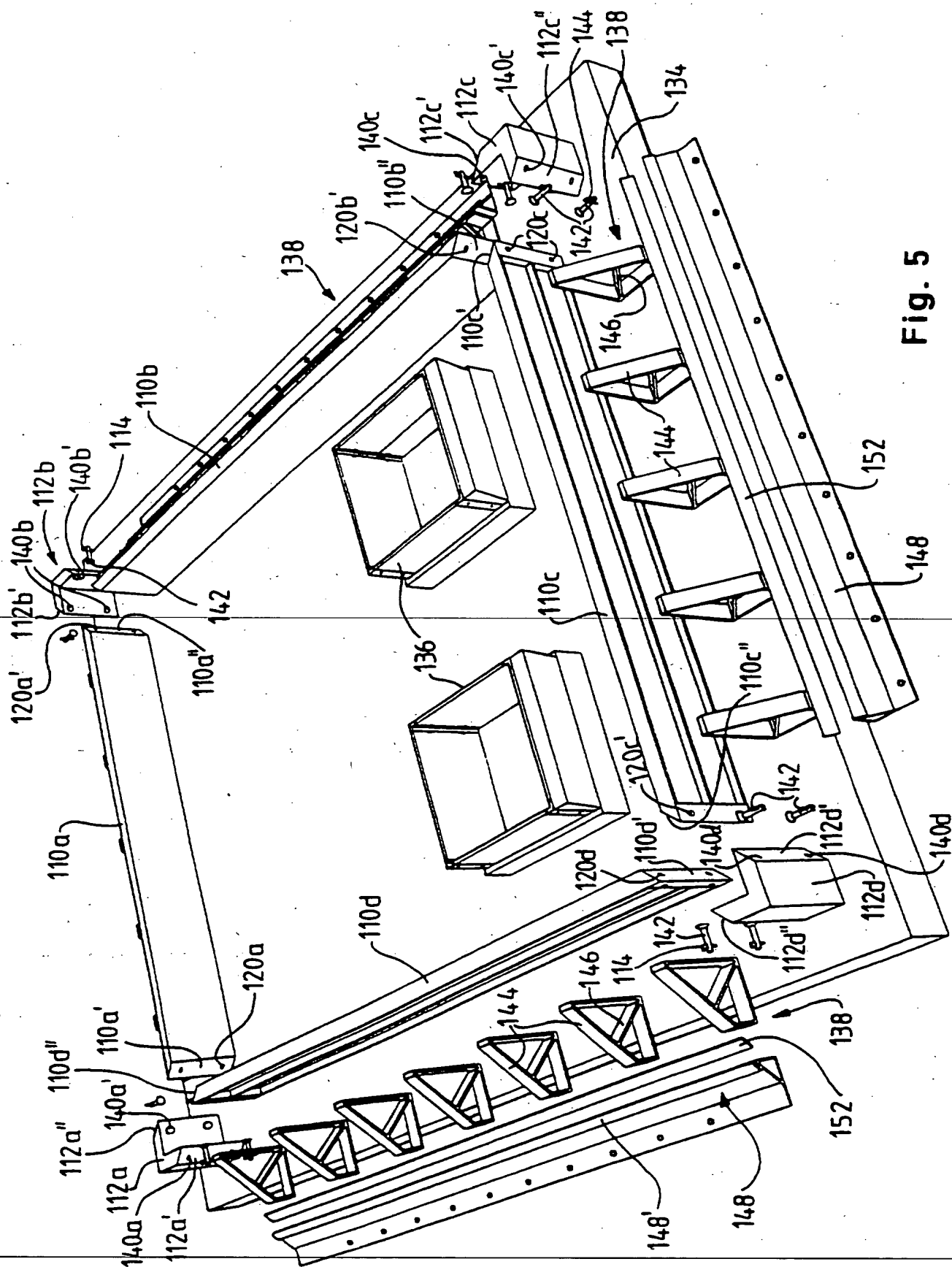


Fig. 5



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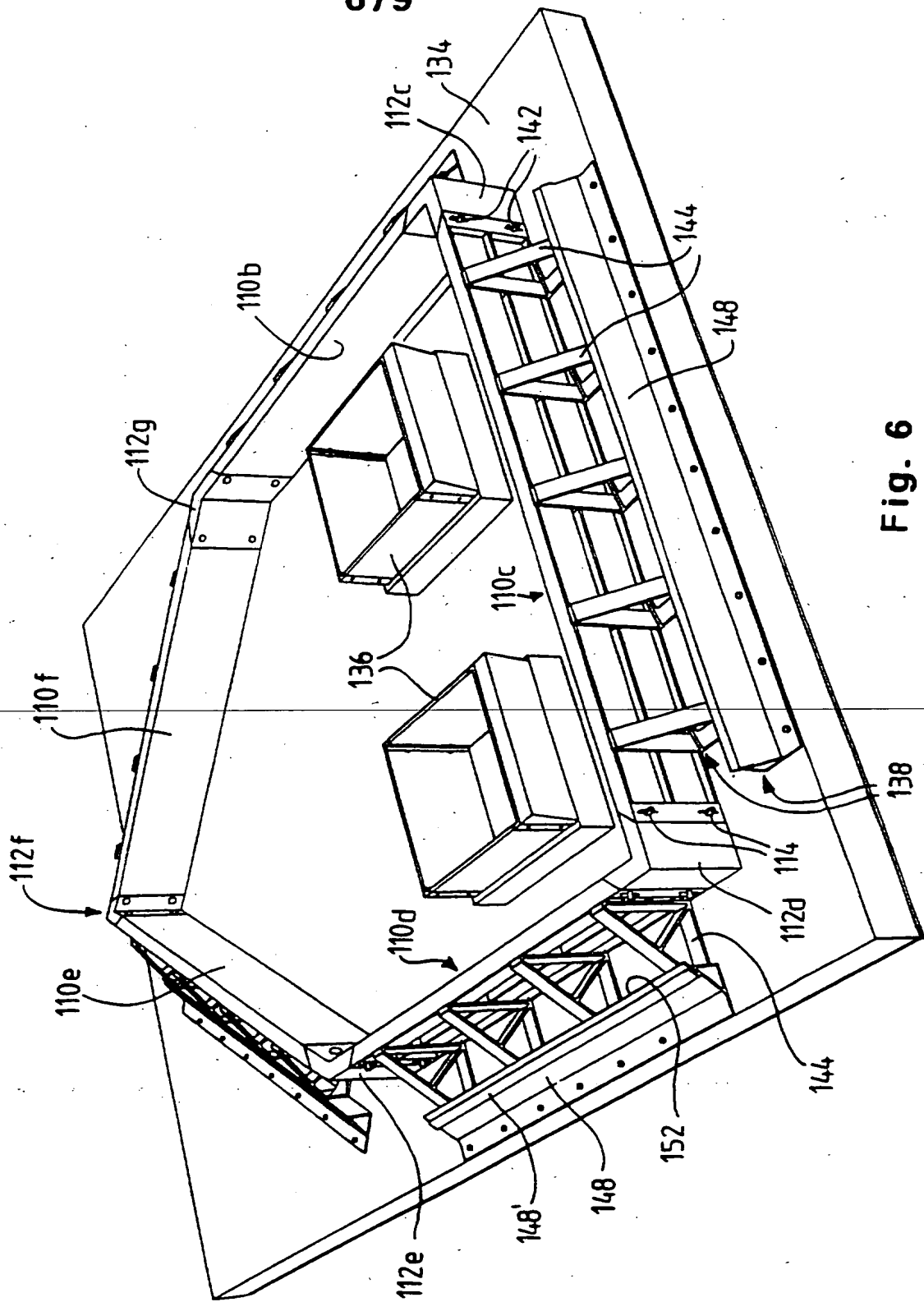
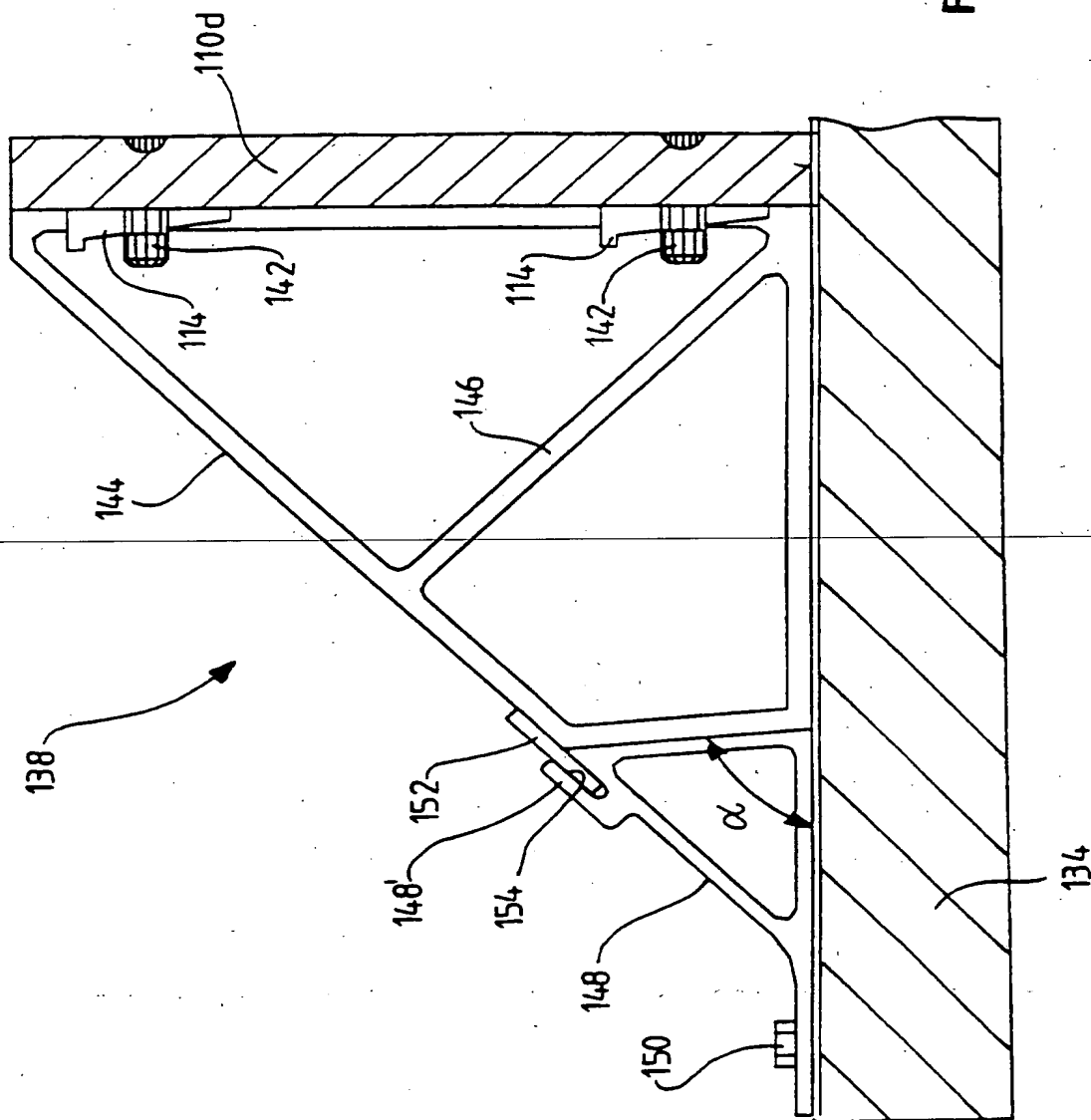


Fig. 6

Fig. 7



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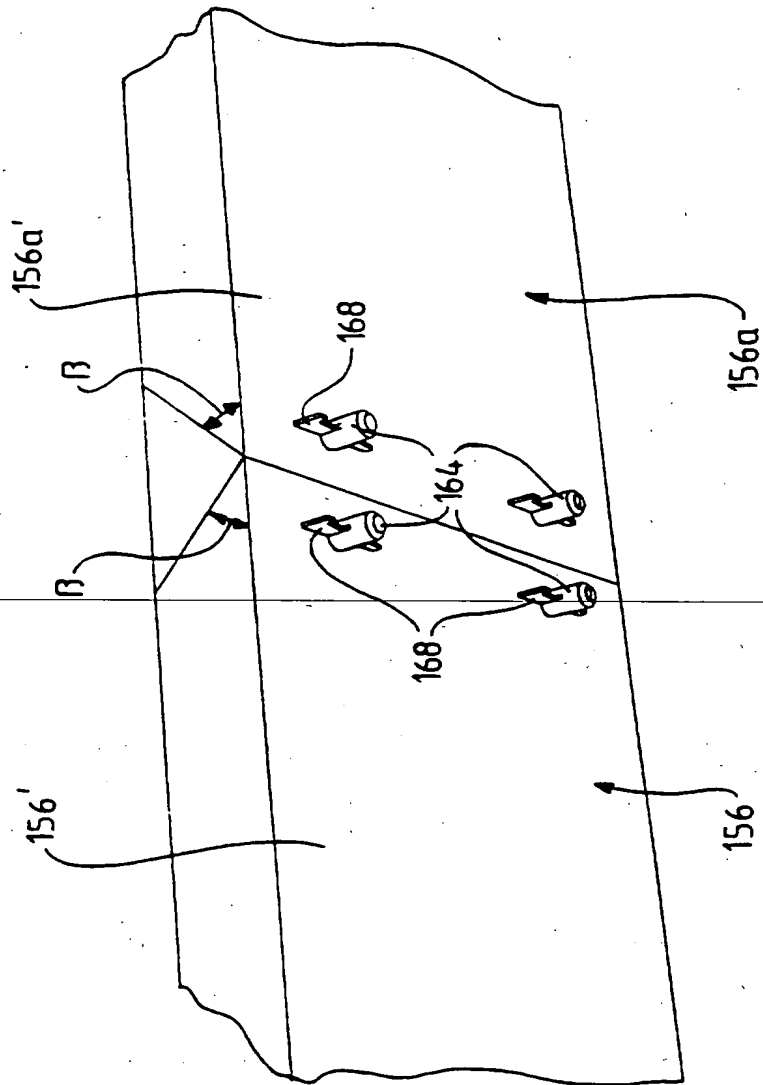


Fig. 8

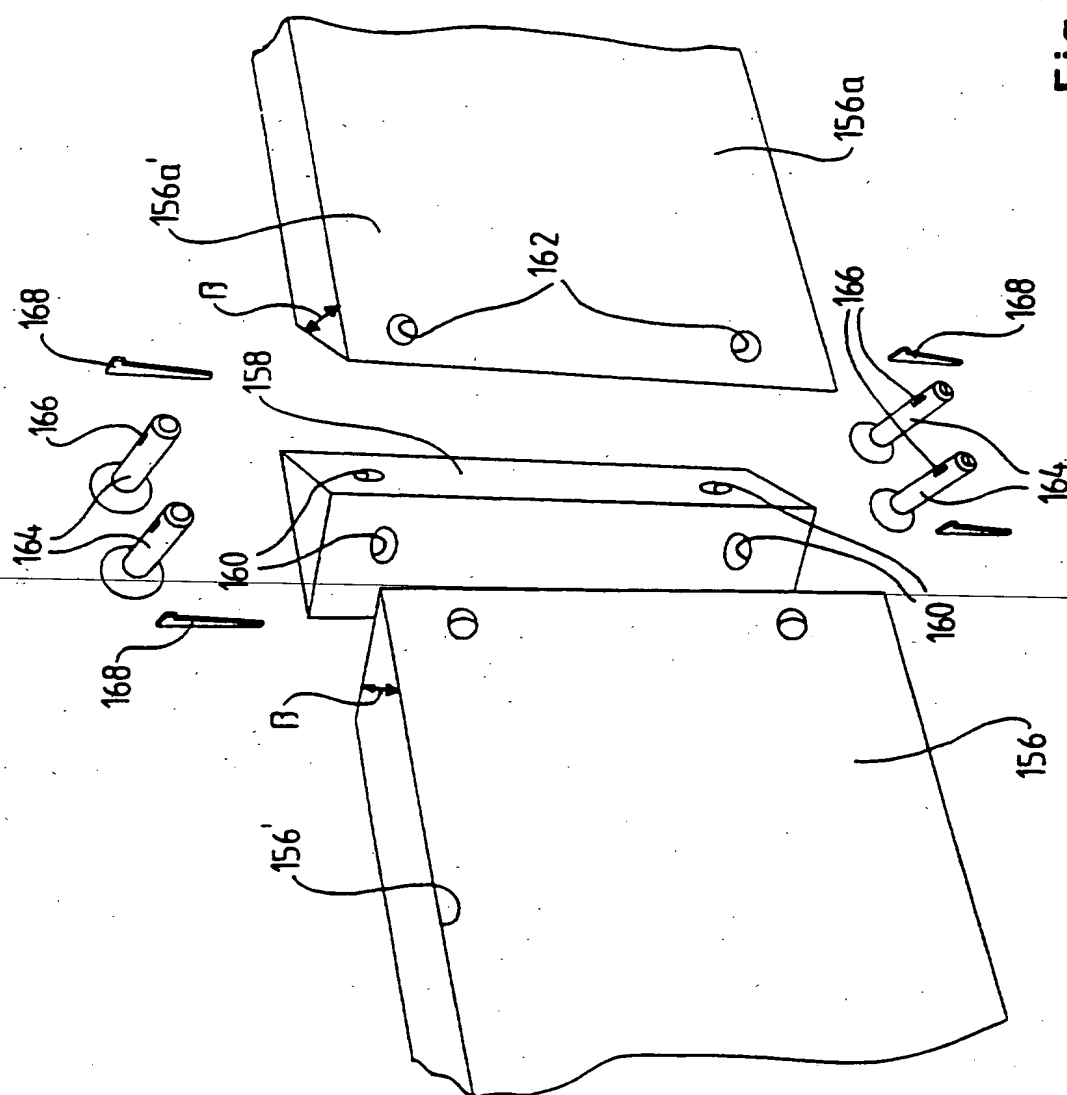


Fig. 9

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 95/00207

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B28B 7/22, E04G 15/02, E04G 17/04 // E04G 11/08  
According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B28B, E04G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2479735 A1 (LONGINOTTI SPA), 9 October 1981 (09.10.81), figures 4-7 --	1-11
A	FR 1601617 A (KRASNOPRESNENSKY ZAVOD ZHELEZOBETONNYKH KONSTRUKTSY), 16 October 1970 (16.10.70), figure 1 --	1-11
A	EP 0542116 A1 (SCHÖCK BAUTEILE GMBH), 19 May 1993 (19.05.93), figure 1, abstract --	1-11
A	DE 3929923 C2 (BÄUMANN VERWERTUNGSGESELLSCHAFT GMBH), 17 December 1992 (17.12.92), figure 1 --	1-11

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

- \* Special categories of cited documents
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- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search

14 February 1996

Date of mailing of the international search report

19.02.96.

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 1319929 A (J.J. MILLER), 28 October 1919 (28.10.19), figures 9-10 --	1-11
A	SE 455210 B (YUAN-HO LEE), 27 June 1988 (27.06.88), figure 3, abstract -- -----	1-11

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

05/01/96

International application No.

PCT/NO 95/00207

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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FR-A-	1601617	16/10/70	NONE		
EP-A1-	0542116	19/05/93	DE-A-	4137571	19/05/93
DE-C2-	3929923	17/12/92	NONE		
US-A-	1319929	28/10/19	NONE		
SE-B-	455210	27/06/88	BE-A, A-	901756	29/05/85
			CA-A-	1235921	03/05/88
			CH-A-	663443	15/12/87
			DE-A-	3501125	17/07/86
			FR-A-	2577263	14/08/86
			GB-A, B-	2168411	18/06/86
			SE-A-	8500228	19/07/86
			US-A-	4679762	14/07/87